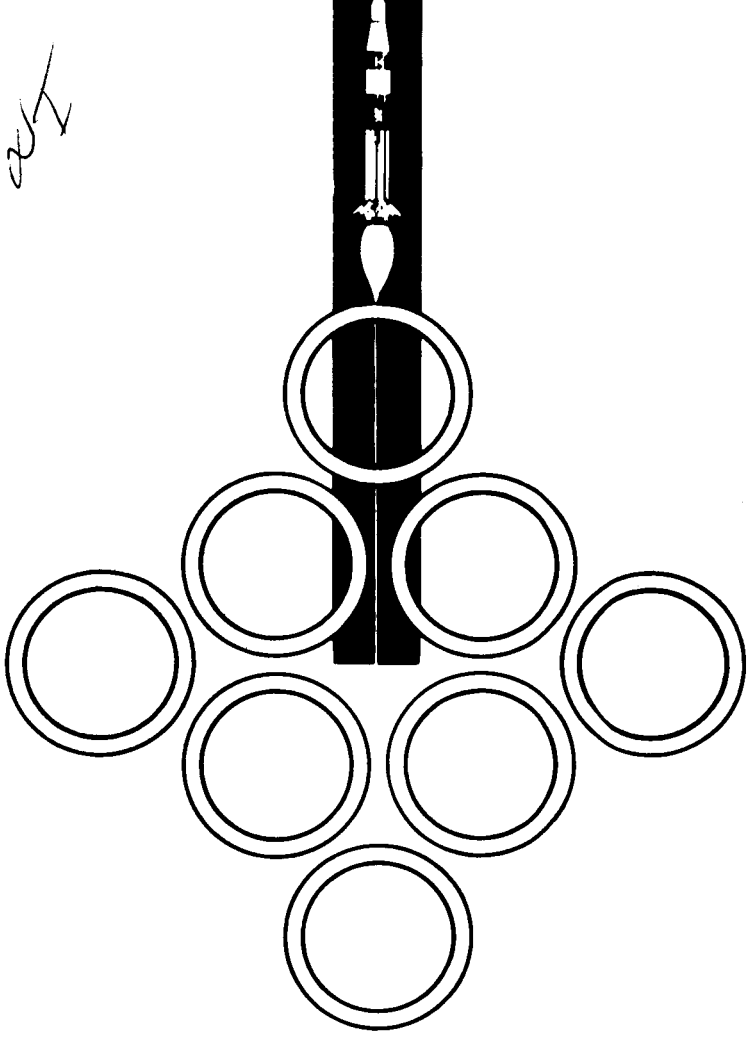

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1067-3

February 17, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

CHECK VALVE, 12-INCH

Mission Valve and Pump Company Part Number 12 Amp-246

NASA Drawing Number 75M04406 PCV-4

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

CHECK VALVE, 12-INCH

Mission Valve and Pump Company Part Number 12 Amp-246

NASA Drawing Number 75M04406 PCV-4

ABSTRACT

This report presents the results of tests performed on two specimens of the Check Valve 75M04406-PCV-4. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Low Temperature
5. High Temperature
6. Flow
7. Surge
8. Life Cycle
9. Burst

The specimen performance was in accordance with the specification requirements of NASA drawing 75M04406 PCV-4 throughout the test program.

It was noted during the initial functional testing that some seat leakage occurred below 50 psig. Seat leakage at 40 psig was less than one scim, and the leakage ceased entirely at 150 psig.

TR-RE-CCSD-FO-1067-3

TEST REPORT

FOR

CHECK VALVE, 12-INCH

Mission Valve and Pump Company Part Number 12 Amp-246

NASA Drawing Number 75M04406 PCV-4

February 17, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS8-4016, Part VII, CWO 271620.

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TEST SUMMARY

CHECK VALVE, 12-INCH

75MO4406 PCV-4

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	1, 2	Specifications and drawings	Conformance to drawings and specifications	Satisfactory	
Proof Pressure Test	1, 2	225 psig	Check for leakage and distortion	Satisfactory	No leakage or distortion
Functional Test	1, 2	150 psig	Determine cracking and reseating pressure Check seat leakage	Satisfactory	Cracking pressure 0.3 psig Reseating pressure 0.1 psig Zero leakage
Low Temperature Test	1, 2	5(+0, -4)°F	Determine if specimen operation is impaired by low temperature	Satisfactory	Test completed
High Temperature Test	1, 2	125(+4, -0)°F	Determine if specimen operation is impaired by high temperature	Satisfactory	Test completed
Flow Test	2	2760 scfm	Determine pressure drop across specimen (0.108 psid, Max).	Satisfactory	Test completed
Surge Test	2	0 to 10 psig at inlet within 100 milliseconds 0 to 100 psig at outlet within 100 milliseconds 500 cycles each direction.	Determine if specimen operation is impaired by surge pressure	Satisfactory	Test completed

TEST SUMMARY (Continued)

CHECK VALVE, 12-INCH

75MO4406 PCV-4

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Life Cycle Test	1, 2	0 to 10 psig at inlet, holding for 1 second and reducing to zero within 1 second. 5000 cycles	Determine if specimen operation is impaired by repeating cycling	Satisfactory	Test Completed
Burst Test	1	600 psig to inlet and outlet port simultaneously 5 minutes	Check for structural damage and leakage at minimum burst pressure	Satisfactory	No leakage or damage
	2	Pressurize outlet until burst	Determine actual burst pressure	Satisfactory	Burst at 2200 psig

Check Valve, 12-Inch, 75M04406 PCV-4

CHECK SHEET

FOR

CHECK VALVE, 12-INCH

MANUFACTURER: Mission Valve and Pump Company
MANUFACTURER'S PART NUMBER: 12 AMP-246
NASA PART NUMBER: 75M04406 PCV-4
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIA:	Dry air or gaseous nitrogen
B.	OPERATING PRESSURE:	150 psig
C.	PROOF PRESSURE:	225 psig
D.	PRESSURE DROP:	3 inches of H_2O with 200 lb per minute of air at 2 psig

II. CONSTRUCTION

A.	BODY MATERIAL:	Aluminum
B.	SPRING MATERIAL:	316 stainless steel
C.	SEAL MATERIAL:	Buna-N
D.	DIAMETER:	12-inch, nominal
E.	END FITTING:	To mate with 150 series, raised-face flange
F.	MOUNTING ATTITUDE:	Valve horizontal with flapper hinges in vertical orientation

III. ENVIRONMENTAL REQUIREMEMENTS

A.	OPERATING TEMPERATURE:	The temperature shall range from 0 to + 165°F

IV. SPECIAL REQUIREMENTS: Cleaning Specification A10509305

V. LOCATION AND USE: Used in environmental control system to protect against overpressurization of air conditioning ducts.

SECTION I

INTRODUCTION

1.1 SCOPE

This report presents the results of tests that were performed to determine if check valve 75M04406 PCV-4 meets the operational and environmental requirements for John F. Kennedy Space Center Launch Complexes 34 and 37. A summary of the test results is presented on pages vi and vii.

1.2 ITEM DESCRIPTION

1.2.1 Two specimens of check valve 75M04406 PCV-4 were tested. The valve is manufactured by Mission Valve and Pump Company as vendor part number 12-Inch, 12 AMP-246. The valve has a nominal size of 12 inches and is designed for mounting between 150 series, raised-face flanges. The valve body is aluminum, the spring is stainless steel, and the seal is Buna-N. The valve has an operating pressure of 150 psig and is designed for use with air or gaseous nitrogen. The check valve is used in the environmental control system and prevents overpressurizing of air-conditioning ducts.

1.3 APPLICABLE DOCUMENTS

1.3.1 The following documents contain the test requirements for check valve 75M04406 PCV-4:

a. 75M04406 PCV-4, Component Specification

b. KSC-STD-164 (D), Environmental Test Methods

c. A10509305, Cleanliness Requirement

d. Test Plan CCSD-FO-1067-1R, Test Requirements

e. Technical Procedure TP-RE-CCSD-FO-1067-2R

SECTION II

RECEIVING INSPECTION

2.1 TEST REQUIREMENTS

Test specimens 1 and 2 shall be checked for conformance with NASA drawing 75M04406 PCV-4, vendor drawings, and applicable specifications to the extent possible without disassembly. The specimens shall also be inspected for poor workmanship and manufacturing defects.

2.2 TEST PROCEDURE

Test specimens 1 and 2 were checked for conformance with drawing 75M04406 PCV-4, vendor drawings, and applicable specifications to the extent possible without disassembly. The specimens were also inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

Specimens 1 and 2 complied with drawing 75M04406 PCV-4. No evidence of poor workmanship or manufacturing defects was observed. Neither specimen was identified by a serial number.

2.4 TEST DATA

The data presented in tables 2-1 and 2-2 were recorded during the inspection.

Table 2-1. Receiving Inspection Test Data

Item	Specimen	
	1	2
Physical description	2 semicircular swing checks	2 semicircular swing checks
Body material	Aluminum	Aluminum
Spring material	Stainless steel	Stainless steel
Seal material	Buna-N	Buna-N
Outside diameter	1 ft, 4-1/16 in.	1 ft, 4-1/16 in.
Width	7-1/8 in.	7-i/8 in.
Inlet port diameter	11-3/8 in.	11-3/8 in.
Outlet port diameter	1 ft, 3/4 in.	1 ft, 3/4 in.

Table 2-2. Receiving Inspection Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Steel scale	Brown & Sharpe	300	NASA 101-1013	Cal date 7-23-64

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

Test specimens 1 and 2 shall be subjected to a proof pressure of 225 psig. This pressure shall be simultaneously applied to the inlet and outlet ports of the specimens. This pressure shall be maintained for 5 minutes and the specimens shall be checked for leakage.

3.2 TEST PROCEDURE

3.2.1 Test specimens 1 and 2 were installed as shown in figures 3-1 and 3-2, utilizing the equipment listed in table 3-1.

3.2.2 Regulator 4 was adjusted for zero outlet pressure. Hand valve 2 was opened and hand valve 9 was closed.

3.2.3 Hand valve 7 was opened and pressure gage 8 was monitored for supply pressure.

3.2.4 By adjusting regulator 4, the specimen pressure, as indicated on pressure gage 3, was slowly increased to 225 psig.

3.2.5 Hand valve 2 was closed.

3.2.6 The pressure of 225 psig was held for 5 minutes and pressure gage 3 was monitored for pressure drop.

3.2.7 The setting of regulator 4 was reduced to zero psig, as indicated on pressure gage 3. Hand valve 9 was opened to vent the specimen.

3.2.8 The test specimen was removed from the test setup and was examined for structural deformities resulting from this test.

3.2.9 The test data were recorded.

3.3 TEST RESULTS

Both specimens satisfactorily withstood the required 225 psig proof pressure. The test specimens did not leak and there was no evidence of distortion.

3.4 TEST DATA

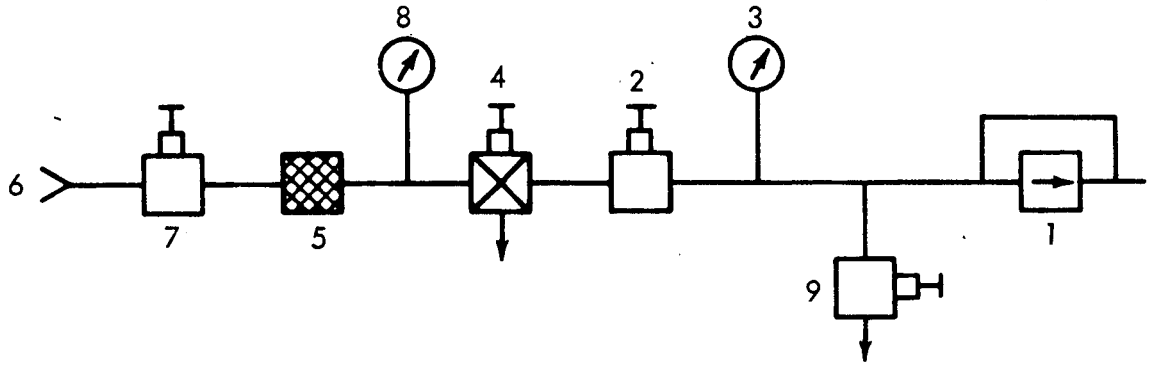
Proof pressure test data are presented in table 3-2.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimens 1 and 2	Mission Valve and Pump Company	12" AMP 246	NA	12-inch check valve
2	Hand Valve	Robbins	SSKG-250 -4T	NA	¼-inch
3	Pressure Gage	Heise	NA	NASA No. 10644-3	0-to 500-psig ±0.1% FS accuracy Cal date 7/21/66
4	Regulator	Tescom	26-1003	1002	0-to 500-psig outlet pressure
5	Filter	Bendix	NA	57	2-micron
6	GN_2 Source	CCSD	NA	NA	500-psig
7	Hand Valve	Combination Pump Valve Company	380-4	NA	1-½-inch
8	Pressure Gage	Ashcroft	NA	NASA 200595-K	±0.5% FS accuracy Cal date 7/21/66
9	Hand Valve	Robbins	SSKG-250 -4T	NA	¼-inch

Table 3-2. Proof Pressure Test Data

Specimen	Applied Pressure	Time Pressurized (minutes)	Results
1	225 psig	5	No leakage or distortion
2	225 psig	5	No leakage or distortion



NOTE:

ALL LINES 1/4 INCH.
REFER TO TABLE 3-1 FOR ITEM IDENTIFICATION.

Figure 3-1. Proof Pressure Test Schematic

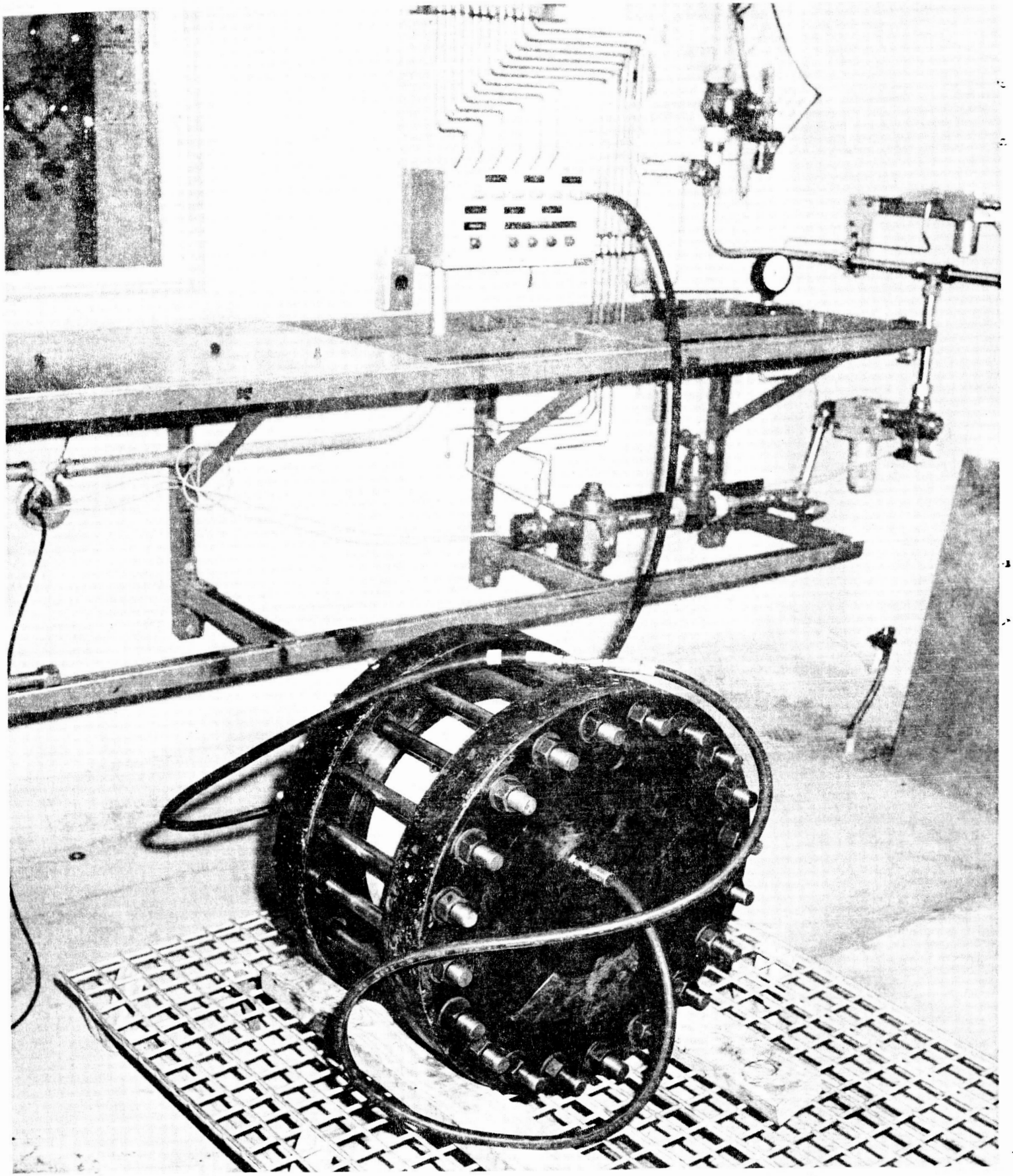


Figure 3-2. Proof Pressure Test Setup

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 Functional tests shall be performed on test specimens 1 and 2.

4.1.2 The cracking and reseating pressures of the test specimens shall be determined.

4.1.3 The test specimens shall be checked for leakage.

4.2 TEST PROCEDURE

4.2.1 Test specimens 1 and 2 were set up as shown in figures 4-1 and 4-2, utilizing the equipment listed in table 4-1.

4.2.2 All valves were closed and regulator 6 was adjusted for zero outlet pressure.

4.2.3 Hand valve 9 was opened and the supply pressure was monitored on gage 10.

4.2.4 Hand valves 4, 13, 15 and 18 were opened.

4.2.5 The outlet pressure of regulator 6 was slowly increased from zero to 0.5 psig as indicated on pressure gage 3.

4.2.6 The reading on manometer 17 was recorded at the instant bubbles appeared in water tank 5. This was the specimen's cracking pressure.

4.2.7 Hand valve 18 was closed, and regulator 6 was adjusted until gage 3 read 10 psig. The outlet pressure of regulator 6 was slowly reduced from 10 psig to 0.5 psig as indicated on pressure gage 3. Hand valve 18 was opened.

4.2.8 The outlet pressure of regulator 6 was slowly reduced to zero, and the reading on manometer 17 was recorded at the instant bubbles ceased to appear in water tank 5. This was the specimen's reseating pressure.

4.2.9 Hand valves 4, 13, 15 and 18 were closed.

4.2.10 Hand valves 11 and 12 were opened

4.2.11 The outlet pressure of regulator 6 was slowly increased from zero psig to 150 psig as indicated on gage 2.

4.2.12 Flowmeter 14 was monitored for inlet port leakage. Leakage was recorded.

4.2.13 The outlet pressure of regulator 6 was reduced to zero. Hand valves 11 and 12 were closed.

4.2.14 Steps described in 4.2.4 through 4.2.8 were repeated fifteen times, and the steps described in 4.2.9 through 4.2.13 were repeated twice during the initial functional test.

4.2.15 During all subsequent functional tests, the procedure described in 4.2.4 through 4.2.8 was performed five times and the procedure described in 4.2.9 through 4.2.13 were performed twice.

4.3 TEST RESULTS

4.3.1 The cracking pressure was 0.40 to 0.60 inches of H_2O, and reseating pressure was 0.10 to 0.2 inches of H_2O for the specimens 1 and 2.

4.3.2 During the initial pressurization of the specimens, the outlet ports were pressurized at 150 psig for 5 minutes. Specimens 1 and 2 leaked less than 1 scim below 50 psig, and the leakage ceased entirely when the pressure was increased to 150 psig.

4.4 TEST DATA

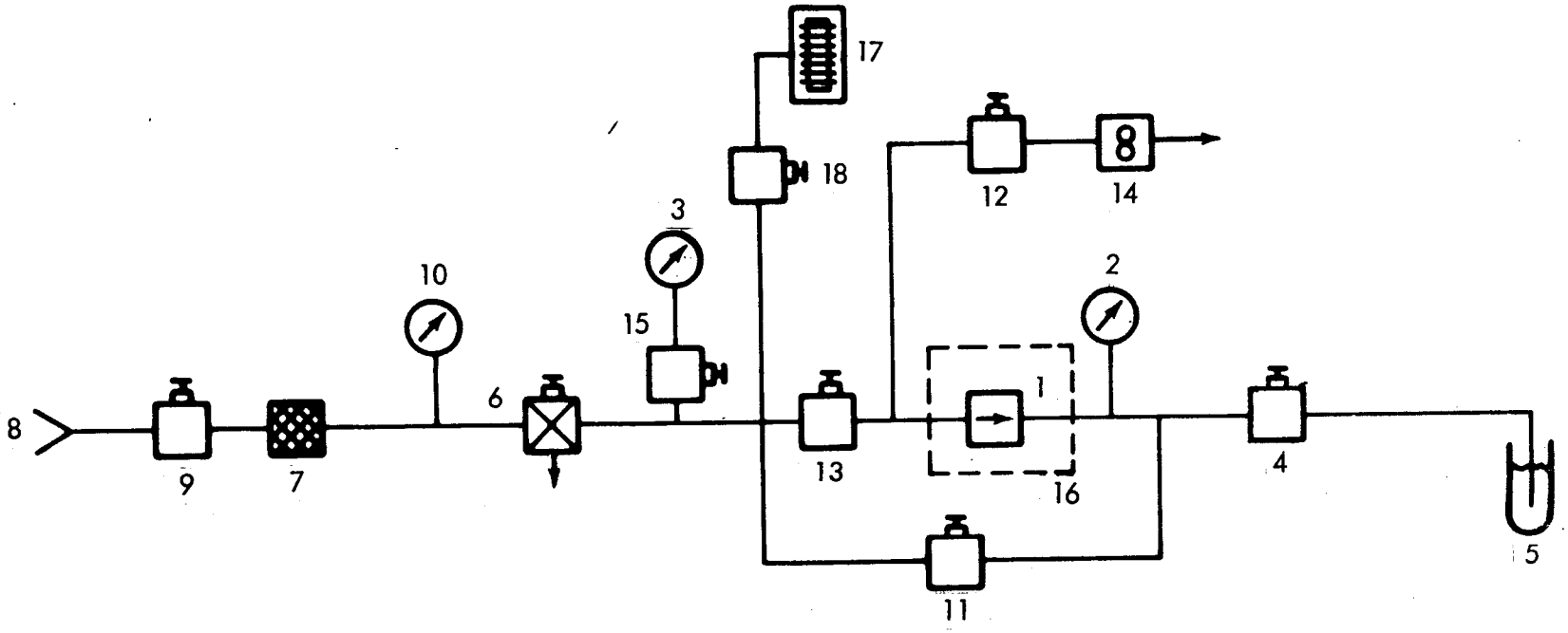
The test data are presented in table 4-2.

Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Mission Valve and Pump Company	12" C 12 AMP 246	NA	12-inch check valve
2	Pressure Gage	Ashcroft	NA	NASA 95-1403-B	0-to 200-psig 0.1% FS accuracy Cal date 8/11/66
4	Hand Valve	Robbins	SSKG-250 -4T	NA	¼-inch
5	Water Tank	CCSD	NA	NA	Tap water
6	Regulator	Tescom Corporation	26-1003	1004	0-to 200-psig outlet pressure
7	Filter	Bendix	2-3-1480-16-8-0	59	2-micron
8	GN_2 Source	CCSD	NA	NA	200-psig
9	Hand Valve	Combination Pump Valve Company	380-4	NA	1½-inch
10	Pressure Gage	Ashcroft	NA	NASA 200594-0	0-to 5000-psig ±0.5% FS accuracy Cal date 9/9/66
11	Hand Valve	Robbins	SSKG-250-4T	NA	¼-inch
12	Hand Valve	Robbins	SSKG-250-4T	NA	¼-inch
13	Hand Valve	Robbins	SSKG-250-4T	NA	¼-inch
14	Flowmeter	CCMD	NA	NASA 200595	0-to 1460-scim (water displacement) Cal date 8/13/66
15	Hand Valve	Robbins	SSKG-250-4T	NA	¼-inch
16	Temperature Chamber	Conrad	NA	NASA 200922	0°F to + 165°F (for temperature tests only)
17	Momometer	Meriann Instrument Company	NA	NASA 106-1124-B	15 Inches H_2O Cal date 4/8/65
18	Hand Valve	Robbins	SSKG-250 -4T		¼-inch

Table 4-2. Cracking and Reseating Pressures

Run No.	Cracking Pressure (in. H_2O)		Reseating Pressure (in. H_2O)	
	Specimen		Specimen	
	1	2	1	2
1	0.40	0.50	0.20	0.10
2	0.40	0.50	0.20	0.10
3	0.40	0.50	0.20	0.10
4	0.40	0.60	0.20	0.10
5	0.40	0.50	0.20	0.10
6	0.40	0.50	0.20	0.10
7	0.40	0.50	0.20	0.10
8	0.40	0.50	0.20	0.10
9	0.40	0.50	0.20	0.10
10	0.40	0.50	0.20	0.10
11	0.40	0.50	0.20	0.10
12	0.40	0.50	0.20	0.10
13	0.40	0.50	0.20	0.10
14	0.40	0.50	0.20	0.10
15	0.40	0.50	0.20	0.10



NOTE:

ALL LINES 1/4 INCH.
REFER TO TABLE 4-1FOR ITEM IDENTIFICATION.

Figure 4-1. Functional Test Schematic

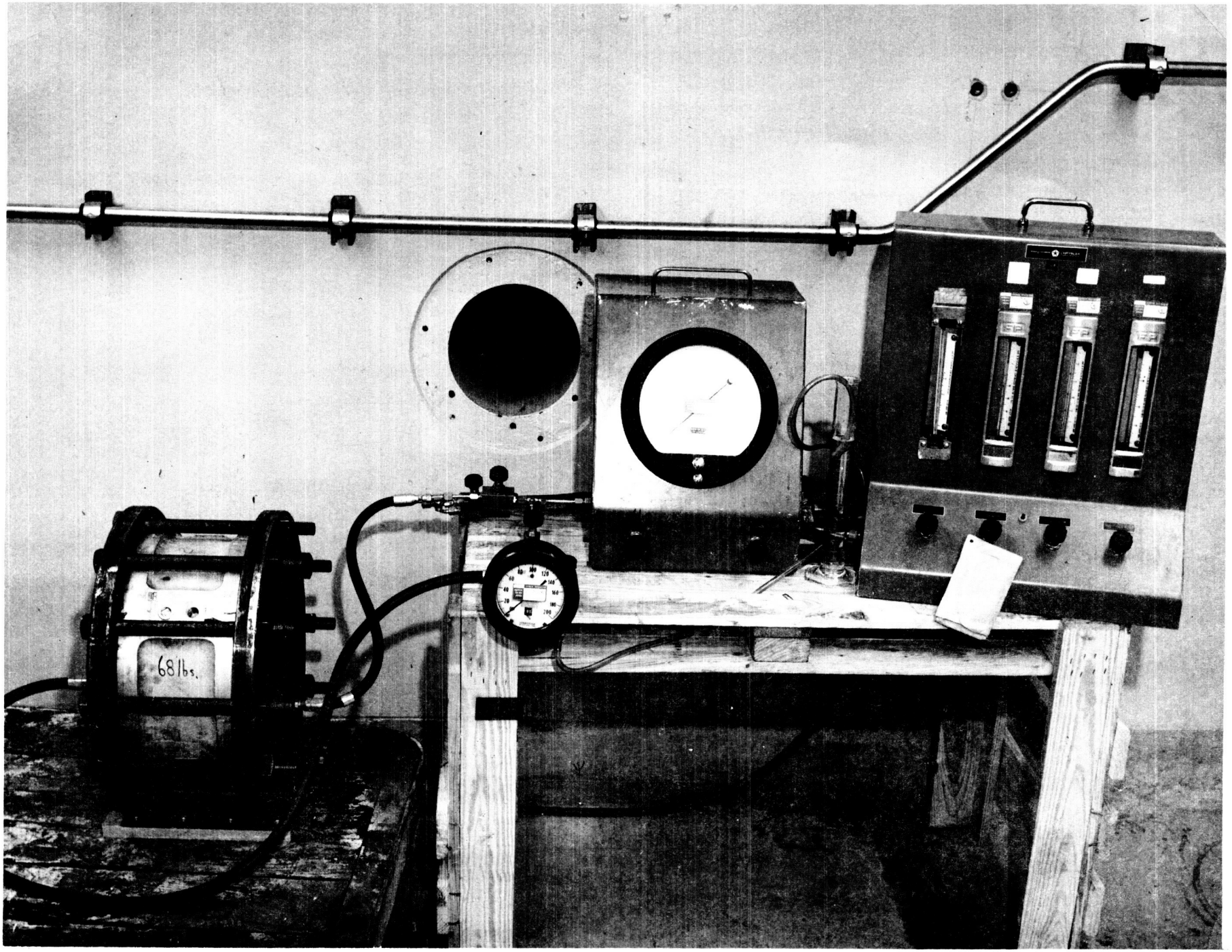


Figure 4-2. Functional Test Setup

SECTION V

LOW TEMPERATURE TEST

5.1 TEST REQUIREMENTS

5.1.1 A low temperature test shall be performed on test specimen 1 and 2 to determine whether the environment causes degradation or deformation.

5.1.2 The rated low temperature is 5(+0, -4)°F.

5.1.3 A functional test shall be performed during this test.

5.2 TEST PROCEDURE

5.2.1 Specimens 1 and 2 were installed in a low temperature setup as shown in figures 4-1 and 5-1, utilizing the equipment listed in table 4-1.

5.2.2 The chamber was controlled to the specified test conditions, while maintaining a relative humidity between 60 and 90 per cent.

5.2.3 A functional test was performed when temperature stabilization was obtained. Temperature stabilization is defined as a maximum temperature change rate of 1°F per minute as determined from the instrumentation monitoring the test specimen.

5.2.4 The chamber temperature was returned to ambient conditions upon completion of the functional test.

5.2.5 Specimens 1 and 2 were visually inspected and functionally tested within one hour after being returned to room ambient conditions.

5.2.6 All test data were recorded.

5.3 TEST RESULTS

5.3.1 Test specimens 1 and 2 functioned satisfactorily during and following the low temperature test.

5.4 TEST DATA

5.4.1 The functional test data presented in tables 5-1 and 5-2 were recorded during the low temperature test and immediately after the specimens were returned to room ambient conditions.

5.4.2 No leakage existed at the inlet port while the outlet port was pressurized to 150 psig during or after the low temperature test.

Table 5-1. Cracking and Reseating Pressures During Low Temperature Test

Run No.	Cracking Pressure (in. H_2O) Specimen		Reseating Pressure (in. H_2O) Specimen	
	1	2	1	2
1	0.50	0.30	0.20	0.10
2	0.40	0.40	0.10	0.05
3	0.40	0.35	0.10	0.05
4	0.40	0.35	0.05	0.05
5	0.30	0.40	0.10	0.10

Table 5-2. Cracking and Reseating Pressures At Ambient Conditions

Run No.	Cracking Pressure (in. H_2O) Specimen		Reseating Pressure (in. H_2O) Specimen	
	1	2	1	2
1	0.30	0.40	0.10	0.20
2	0.40	0.60	0.20	0.20
3	0.50	0.40	0.10	0.10
4	0.50	0.40	0.10	0.20
5	0.50	0.40	0.10	0.20

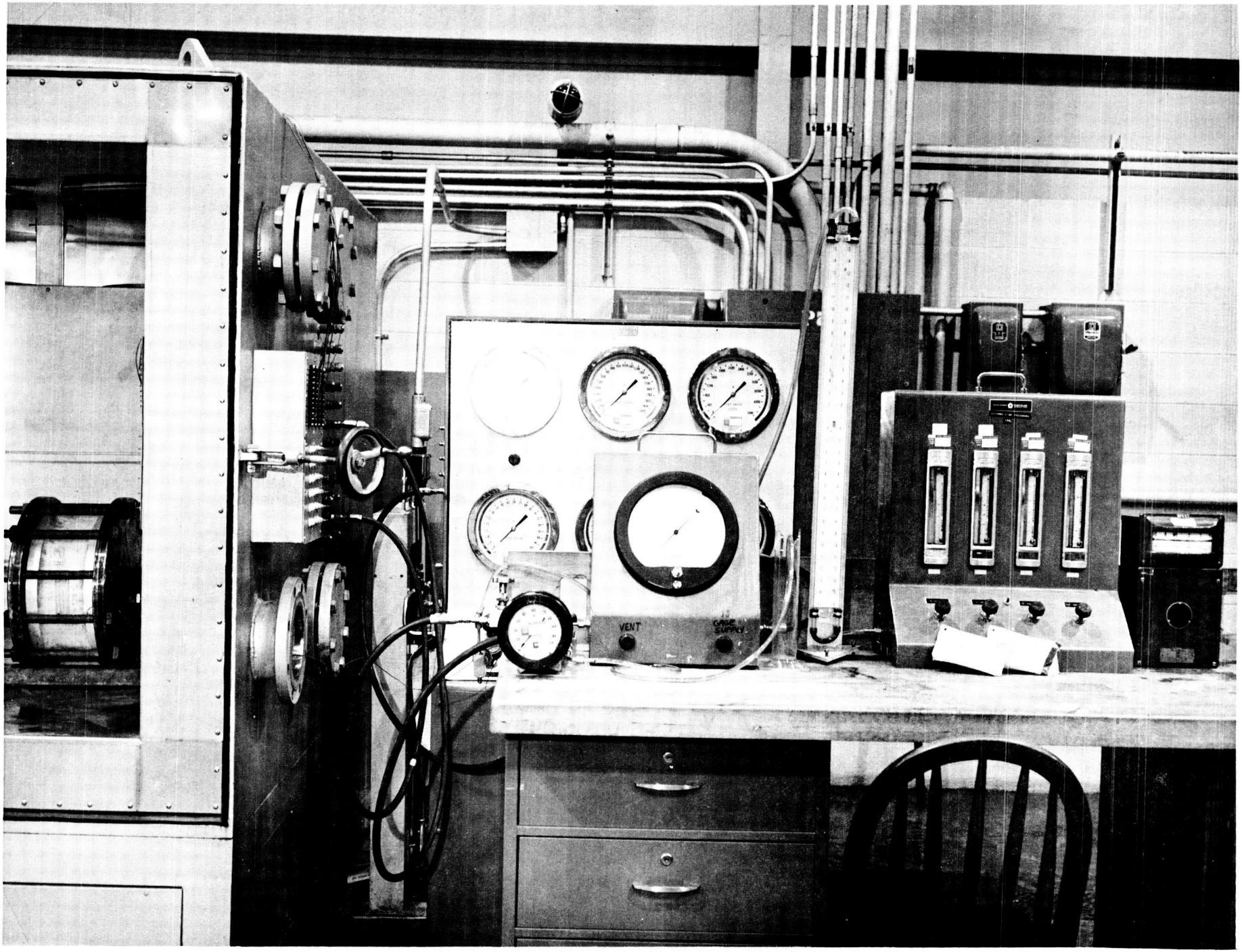


Figure 5-1. Low and High Temperature Test Setup

SECTION VI

HIGH TEMPERATURE TEST

6.1 TEST REQUIREMENTS

6.1.1 A high temperature test will be performed on test specimens 1 and 2 to determine whether the environment causes degradation or deformation.

6.1.2 The rated high temperature is 125(+4, -0)°F.

6.1.3 A functional test shall be performed during this test.

6.2 TEST PROCEDURE

6.2.1 Specimens 1 and 2 were installed in a high temperature test setup as shown in figures 4-1 and 5-1, utilizing the equipment listed in table 4-1.

6.2.2 The chamber was controlled to the specified test conditions, maintaining a relative humidity of 20(±5) per cent.

6.2.3 The chamber temperature was maintained for 72 hours.

6.2.4 A functional test was conducted while the chamber temperature was maintained.

6.2.5 The chamber temperature was returned to ambient conditions upon completion of the functional test.

6.2.6 Specimens 1 and 2 were visually inspected and functionally tested within 1 hour after being returned to ambient conditions.

6.2.7 The test data were recorded.

6.3 TEST RESULTS

Test specimens 1 and 2 functioned satisfactorily during and following the high temperature test.

6.4 TEST DATA

6.4.1 The functional data presented in tables 6-1 and 6-2 were recorded during the high temperature test and immediately after the specimens return to ambient conditions.

6.4.2 No leakage existed at the inlet port while the outlet port was pressurized at 150 psig.

Table 6-1. Cracking and Reseating Pressures

During High Temperature Test

Run No.	Cracking Pressure (in. H_2O)		Reseating Pressure (in. H_2O)	
	Specimen		Specimen	
	1	2	1	2
1	0.50	0.30	0.20	0.00
2	0.40	0.30	0.20	0.10
3	0.50	0.40	0.20	0.10
4	0.50	0.40	0.20	0.10
5	0.40	0.40	0.20	0.00

Table 6-2. Cracking and Reseating Pressures

At Ambient Conditions

Run No.	Cracking Pressures (in. H_2O)		Reseating Pressure (in. H_2O)	
	Specimen		Specimen	
	1	2	1	2
1	0.40	0.40	0.10	0.10
2	0.50	0.45	0.10	0.10
3	0.50	0.40	0.20	0.10
4	0.40	0.40	0.10	0.10
5	0.40	0.40	0.10	0.10

SECTION VII

FLOW TEST

7.1 TEST REQUIREMENTS

7.1.1 A flow test will be performed on test specimen 2 to determine the pressure drop across the valve at rated flow conditions.

7.1.2 A functional test shall be performed upon completion of the flow test.

7.2 TEST PROCEDURE

7.2.1 Test specimen 2 was installed in the flow test setup as shown in figures 7-1 and 7-2, utilizing the equipment listed in table 7-3.

7.2.2 Hand valve 10 was opened.

7.2.3 Regulator 4 was adjusted to provide a flow of 200 pounds per minute (2760 scfm) as measured at flow nozzle 6. The flow test calculations were derived by the following equations:

$$W = \frac{P_1 C_D \pi r^2}{\sqrt{T}} \sqrt{\frac{gK}{R} \left(\frac{Z}{K+1}\right) \frac{K+1}{K-1}}$$

Where:

W = flow rate		lb/sec
P_1 = nozzle inlet pressure		psia
$C_D \pi r^2$ = effective nozzle area		$in.^2$
T = nozzle inlet temperature		°R
g = gravitational constand	32.1.3	$\frac{\#M - ft}{\#F - sec^2}$
R = gas constand	55.2	$\frac{ft \# f}{\#M - °R}$
K = specific heat ratio	1.4	

7.2.4 Hand valve 10 was adjusted as required to provide a specimen inlet pressure of 2 psig, as indicated on gage 8.

7.2.5 While maintaining the conditions described in 7.2.3 and 7.2.4 the pressure drop across the valve, as indicated by gage 9, was read.

7.2.6 A functional test was performed within 1 hour after completion of the flow test.

7.3 TEST RESULTS

7.3.1 The pressure drop across the specimen at 200 lbs/min flow was 2.41 inches of H_2O (0.087 psid). This was below the maximum allowable value of 3 inches of water (0.108 psid).

7.4 TEST DATA

7.4.1 Flow test data are presented in table 7-1. Functional test data taken after the flow test are presented in table 7-2.

7.4.2 No leakage existed at the inlet port while the outlet port was pressurized at 150 psig.

Table 7-1. Pressure Drop During Flow Test (Specimen 2)

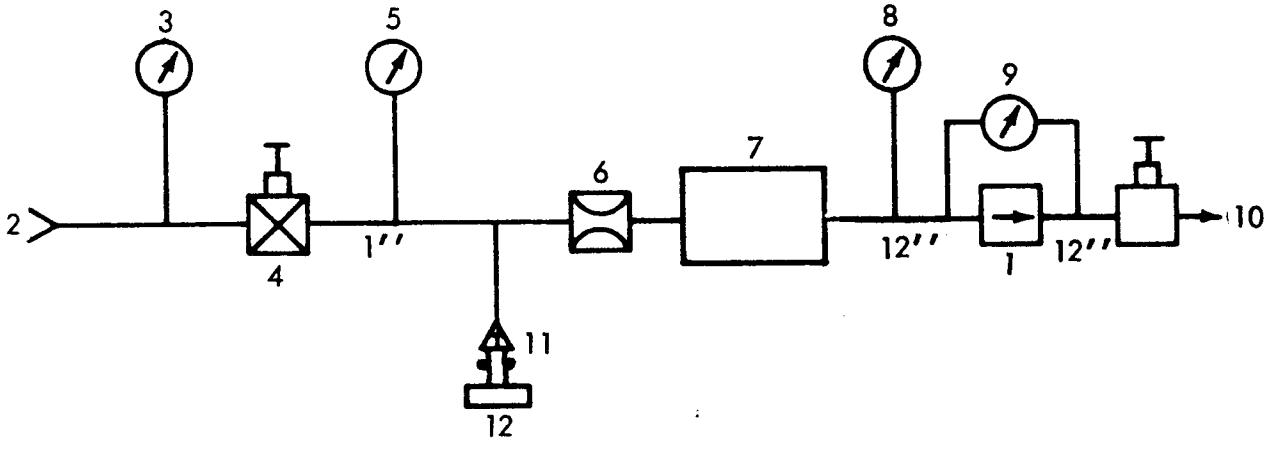
Nozzle Diameter (in.)	Nozzle Inlet Pressure (psig)	Nozzle Inlet Temperature (°R)	Flow Rate lb/min GN_2	Specimen Upstream Pressure (psig)	Pressure Drop Across Specimen (in. H_2O)
0.479	710	480	199.8	2.0	2.41

Table 7-2. Cracking and Reseating Pressures (Specimen 2)

Test No.	Cracking Pressure (in. H_2O)	Reseating Pressure (in. H_2O)
	Specimen 2	Specimen 2
1	0.50	0.10
2	0.50	0.10
3	0.50	0.10
4	0.50	0.10
5	0.50	0.10

Table 7-3. Flow Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Mission Valve and Pump Co.	12" AMP 246	NA	12-inch check valve
2	GN_2 Supply	CCSD	NA	NA	3500-psig
3	Pressure gage	Ashcroft	NA	NASA 109-1002 -B	0-to 20,000-psig ±0.5% FS accuracy Cal date 4/13/66
4	Regulator	Grove	WH-408-N4	RA-5922	High Flow 0-to 2000-psig outlet
5	Pressure Gage	Hiese	NA	NASA 012448	0-to 1000-psig ±0.5% FS accuracy Cal date 8/13/66
6	Flow Nozzle	Flow Dyne Engineering Inc.	XN32047B -SGP	2324	0.497 diameter nozzle 0-to 5000-scfm
7	Ullage Tank	CCSD	NA	NA	500-cubic foot 50-psig rating
8	Pressure Gage	Hiese	NA	NASA 95-1392-B	0-to 30-psig ±0.1% FS accuracy Cal date 8/13/66
9	Manometer	Merideth Co.	237323	NASA 95 -1629-B	60 inches H_2O Cal date 10/4/66
10	Gate Valve	Crane Co.	67053	125S	12-inch
11	Thermocouple	Honeywell	NA	NA	Copper-Constantan
12	Thermocouple	West Corporation	NA	NASA 019454	-100 to +400°F Cal date 7/20/66



NOTE:

LINE SIZES AS SHOWN, ALL GAGE LINES ARE 1/4 INCH. REFER TO TABLE 7-1 FOR ITEM IDENTIFICATION.

Figure 7-1. Flow Test Schematic

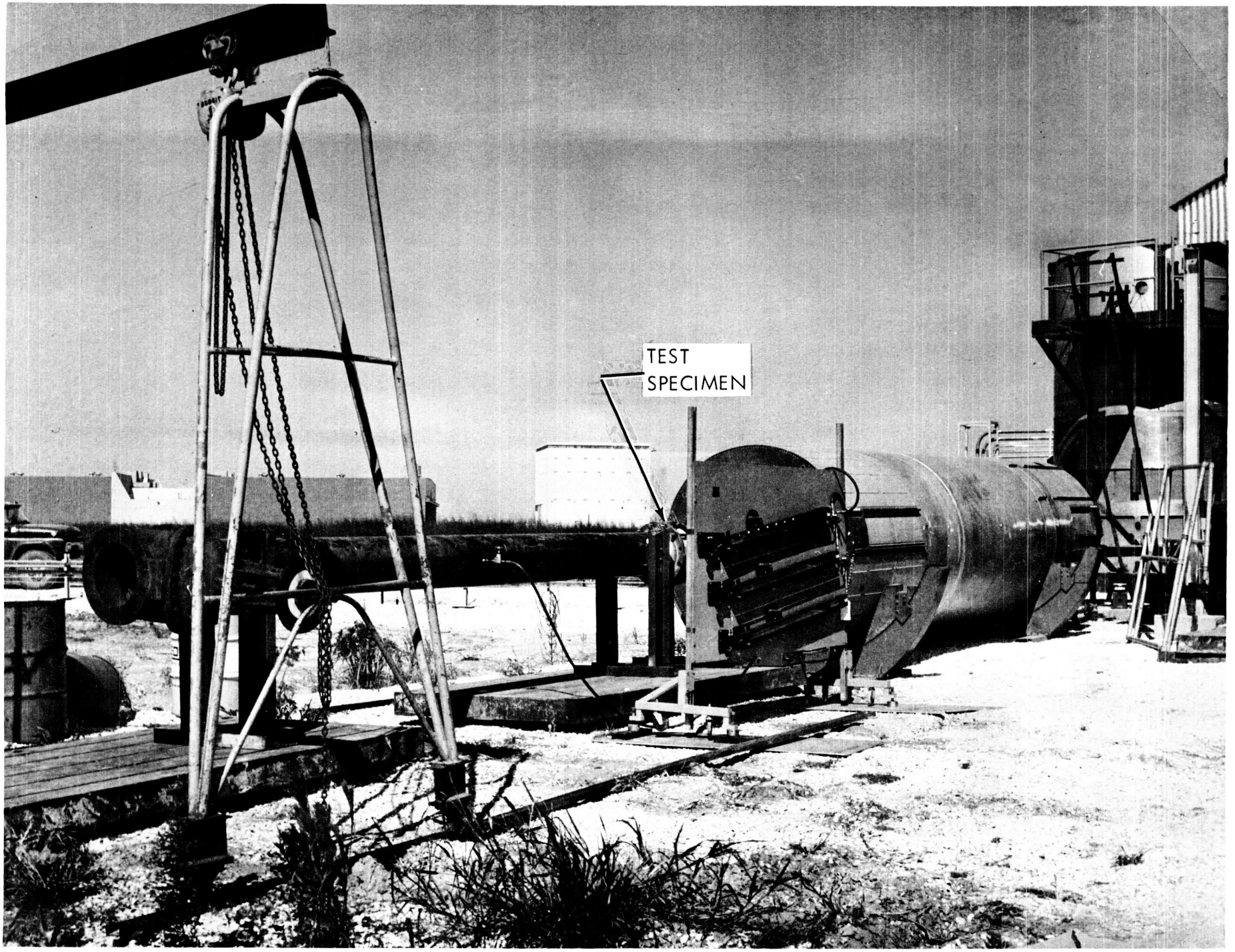


Figure 7-2. Flow Test Setup

SECTION VIII

SURGE TEST

8.1 TEST REQUIREMENTS

8.1.1 A surge test will be performed on test specimen 2 to determine whether the environment causes degradation or deformation.

8.1.2 The specimen inlet shall be pressurized from zero to 10 psig within 100 milliseconds. A total of 500 cycles shall be conducted with a functional test performed after 100 and 500 cycles.

8.1.3 The specimen outlet shall be pressurized from zero to 100 psig within 100 milliseconds for a total of 500 cycles. A functional test shall be performed after completion of 100 and 500 cycles.

8.2 TEST PROCEDURE

8.2.1 The surge test setup was assembled as shown in figures 8-3 and 8-4, 8-4, utilizing the equipment listed in table 8-2. The specimen was placed in position 1 for pressurizing the inlet port.

8.2.2 All hand valves were closed and pressure regulator 9 was adjusted for zero outlet pressure.

8.2.3 Hand valve 14 was slowly opened, and 500 psig, supply pressure was read on pressure gage 13.

8.2.4 Hand valves 12, 15, and 17 were opened.

8.2.5 Regulator 9 was adjusted to establish 10 psig outlet pressure as indicated on pressure gage 2.

8.2.6 Timer 16 was adjusted to cycle solenoid valve 5 at approximately 30 cycles per minute.

8.2.7 Hand valve 12 and pressure regulator 9 were adjusted to obtain the required surge pressure of zero to 10 psig within 100 milliseconds, as indicated by transducer 4 and gage 3.

8.2.8 After the required surge waveform had been established, the specimen was subjected to 500 cycles as indicated by counter 8. Hand valves 15 and 17 were closed and a surge history was continuously recorded on oscillograph 6.

8.2.9 A functional test was performed after 100 and 500 surge cycles.

8.2.10 The test specimen was reinstalled in the test setup (position 1A) to allow pressurization of the outlet port.

8.2.11 The procedures described in 8.2.3 through 8.2.12 were repeated except that the outlet port was surged from zero to 100 psig.

8.2.12 All test data were recorded.

8.3 TEST RESULTS

8.3.1 The specimen successfully withstood 500 surge cycles from 0 to 10 psig at the inlet port and 500 cycles from 0 to 100 psig at the outlet port. Functional test results following the surge test were satisfactory.

8.4 TEST DATA

8.4.1 Typical surge waveforms as recorded during the test are presented in figures 8-1 and 8-2.

8.4.2 Functional test data after the surge test are presented in table 8-1.

8.4.3 No leakage existed at the inlet port while the outlet port was pressurized to 150 psig.

Table 8-1. Cracking and Reseating Pressures After Surge Test (Specimen 2)

Run No.	Cracking Pressure (in. H_2O)	Reseating Pressure (in. H_2O)
1	0.50	0.10
2	0.50	0.05
3	0.50	0.10
4	0.50	0.10
5	0.50	0.05

Table 8-2. Surge Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Mission Valve and Pump Company	12 AMP 246	NA	12-inch check valve
2	Pressure Gage	Ashcroft	NA	NASA 200594-H	0-to 300-psig ±0.25% FS accuracy Cal date 9/9/66
3	Pressure Gage	Ashcroft	NA	NASA 200594-X	0-to 160-psig ±0.25% FS accuracy Cal date 9/9/66
4	Pressure Transducer	Consolidated Electrodynamics Corporation	2471	NASA 95734	0-to 500-psig ±0.25% FS accuracy
5	Solenoid Valve	Marotta Valve Corporation	MV583	371	3-way, normally closed
6	Oscillograph Recorder	Consolidated Electrodynamics Corporation	6382	NASA 017887	Cal date 9/22/66
7	Power Supply	Perkins	MRST-28-300A	63293	28-vdc, 3-amp
8	Counter	Durant	NA	NA	4-digit
9	Regulator	Tescom Corp.	26-1003	1004	0-to 200-psig outlet
10	Filter	Bendix	2-3-1480 16-8-0	59	2-micron
11	GN_2 Source	CCSD	NA	NA	500-psig
12	Hand Valve	Anderson Greenwood & Company	HIV-P8T	NA	Throttling, 1-inch
13	Pressure Gage	Ashcroft	NA	NASA 200594-O	0-to 5000-psig ±0.5% FS accuracy Cal date 9/9/66

Table 8-2. Surge Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
14	Hand Valve	Combination Pump and Valve Co.	380-4	NA	1 ½-inch
15	Hand Valve	Robbins	SSKG-250-4T	NA	¼-inch
16	Timer	Cramer Controls	523	Y2389A	Cam operated
17	Hand Valve	Robbins	SSKG-250-4T	NA	¼-inch

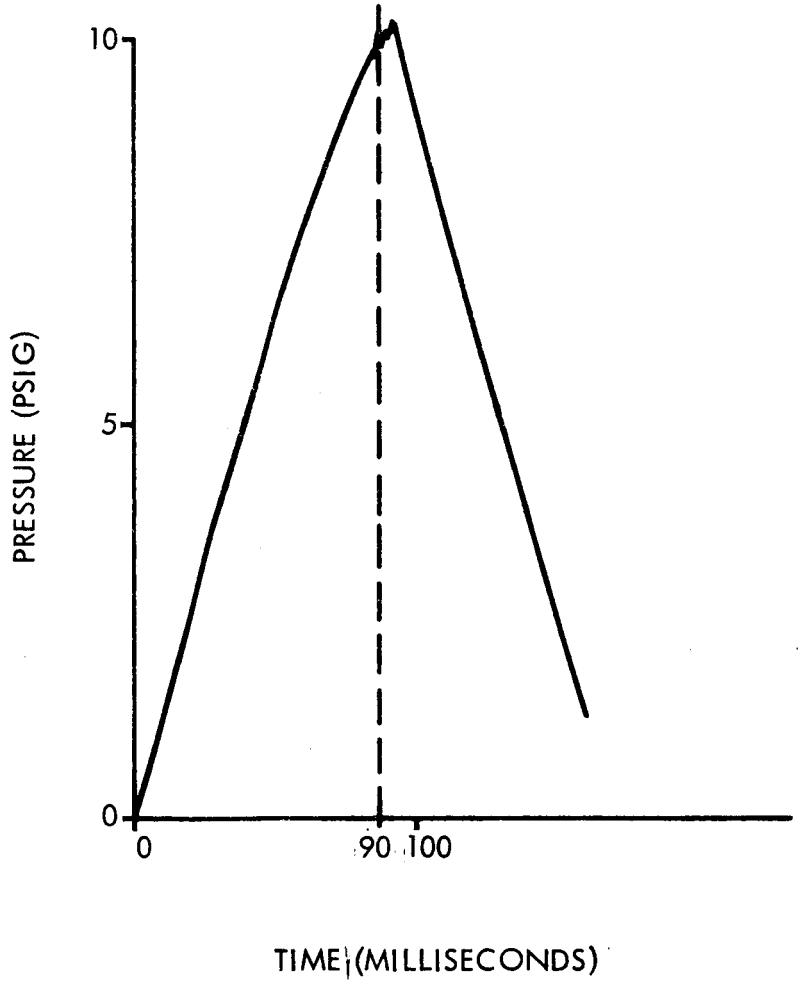


Figure 8-1. Typical Surge Waveform (Inlet Port)

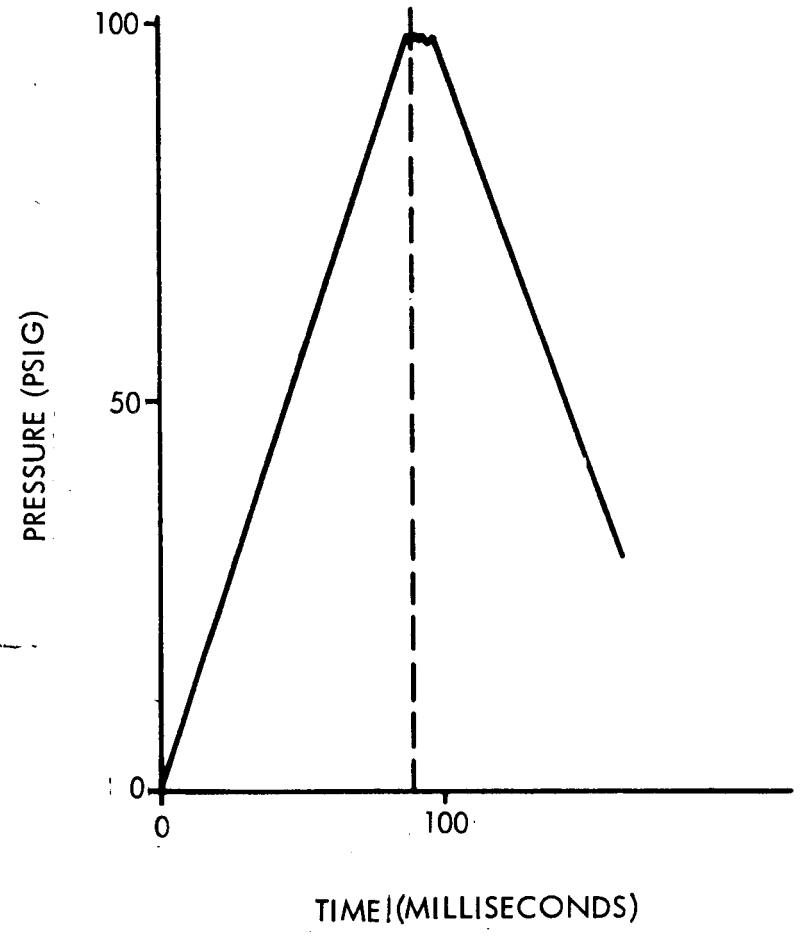
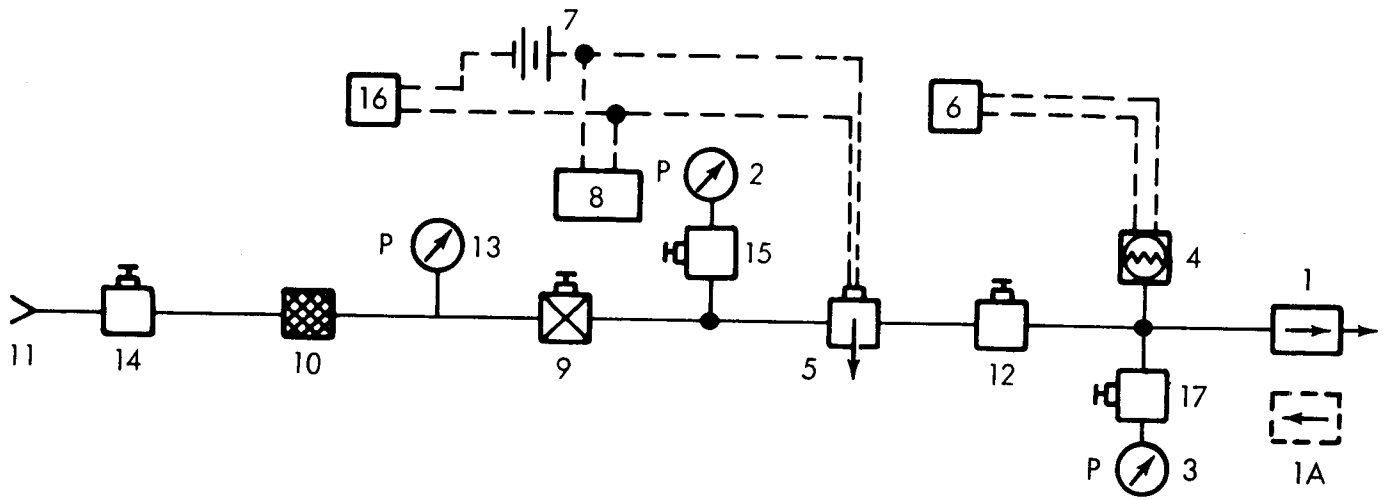


Figure 8-2. Typical Surge Waveform (Outlet Port)



NOTE:

ALL LINES 1 INCH EXCEPT FOR GAGE LINES WHICH ARE 1/4 INCH. REFER TO TABLE 8-1 FOR ITEM IDENTIFICATION.

Figure 8-3. Surge Test Schematic

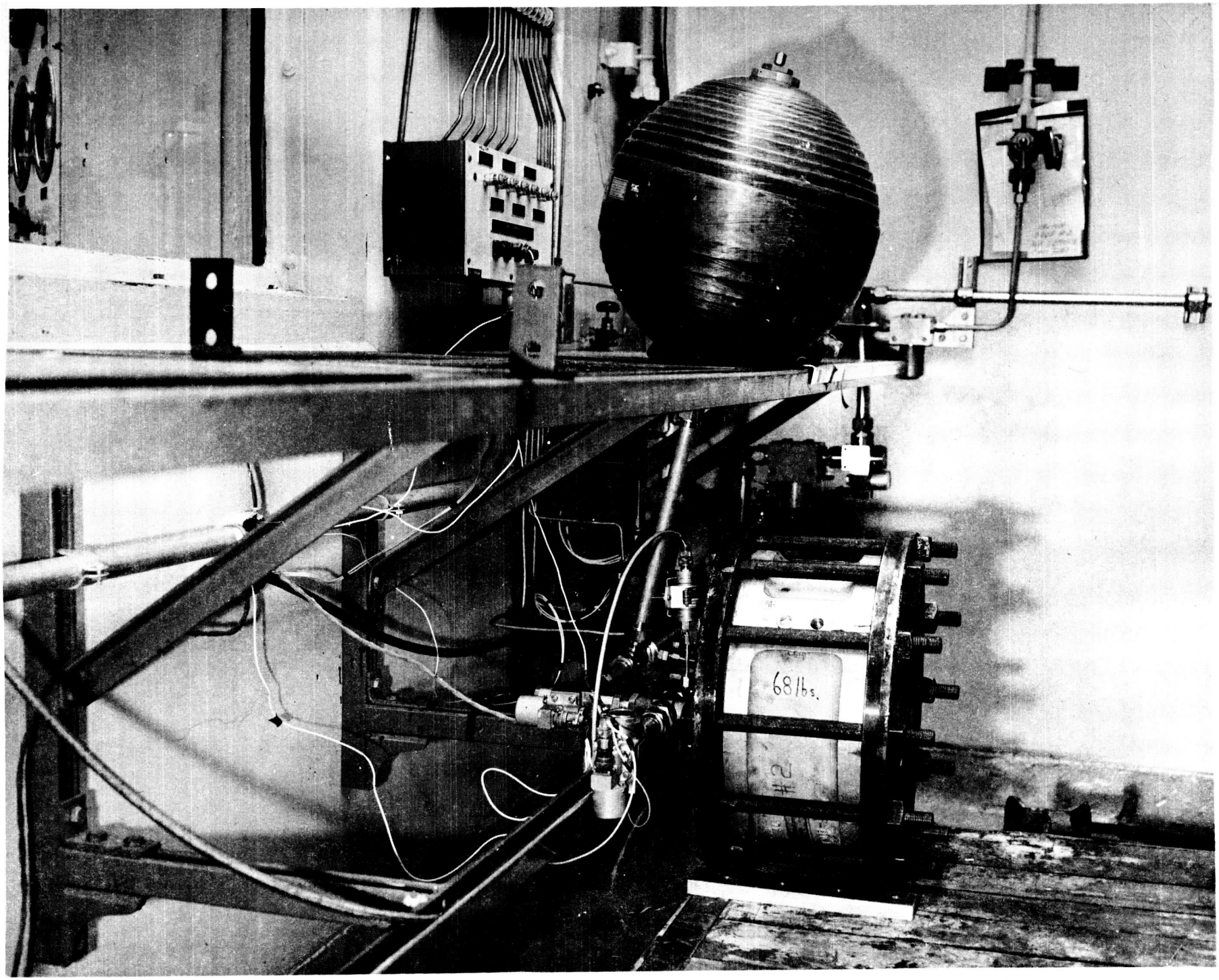


Figure 8-4. Surge Test Setup

SECTION IX

LIFE CYCLE TEST

9.1 TEST REQUIREMENTS

9.1.1 A life cycle test shall be performed on test specimens 1 and 2 to determine whether the environment causes degradation or deformation.

9.1.2 The life cycle shall consist of slowly pressurizing the inlet of the test specimen from zero to 10 psig, maintaining this pressure for a minimum of 1 second, and reducing the pressure to zero within 1 second.

9.1.3 Conduct 5000 cycles with functional tests performed after 100, 500, 1000, and 5000 cycles.

9.2 TEST PROCEDURE

9.2.1 The life cycle test setup was assembled as shown in figure 8-3, utilizing the equipment listed in table 8-1.

9.2.2 All hand valves were closed and pressure regulator 9 was adjusted for zero outlet pressure.

9.2.3 Hand valve 14 was slowly opened, supply pressure gage 13 read 500 psig.

9.2.4 Hand valves 15 and 17 were opened.

9.2.5 Regulator 9 was opened to establish 10 psig as indicated on pressure gage 2.

9.2.6 Timer 16 was adjusted to cycle solenoid valve 5 at approximately 15 cycles per minute.

9.2.7 Hand valve 12, regulator 9, and timer 16 were adjusted as required to cycle the specimen inlet from zero to 10 psig. The 10-psig inlet pressure was maintained for 1 second. The pressure was then reduced to zero, and was maintained for a minimum of 1 second.

9.2.8 After the required life cycle pattern had been established the specimen was subjected to 5000 cycles as indicated by counter 8. Hand valves 15 and 17, were closed and the pressure pattern was periodically recorded on oscillograph 6.

9.2.9 A functional test was performed after 100, 500, 1000, and 5000 cycles. All test data were recorded.

9.3 TEST RESULTS

9.3.1 Test specimens 1 and 2 successfully withstood 5000 operational cycles from zero to 10 psig. The results of functional tests performed during and following the life cycle test were satisfactory.

9.4 TEST DATA

9.4.1 A typical test cycle is presented in figure 9-1. Functional test data are presented in table 9-1.

9.4.2 No leakage existed at the inlet port while the outlet port was pressurized to 150 psig after the life cycle test.

Table 9-1. Cracking and Reseating Pressures

After 100 Cycles

Run No.	Cracking Pressure (psig)		Reseating Pressure (psig)	
	Specimen		Specimen	
	1	2	1	2
1	0.5	0.1	0.5	0.1
2	0.5	0.1	0.5	0.1
3	0.5	0.1	0.5	0.1
4	0.5	0.1	0.5	0.1
5	0.5	0.1	0.5	0.1

Table 9-2. Cracking and Reseating Pressure After 500 Cycles

Run No.	Cracking Pressure (psig)		Reseating Pressure (psig)	
	Specimen		Specimen	
	1	2	1	2
1	0.5	0.5	0.1	0.1
2	0.5	0.5	0.1	0.1
3	0.5	0.5	0.1	0.1
4	0.5	0.5	0.1	0.1
5	0.5	0.5	0.1	0.1

Table 9-3. Cracking and Reseating Pressure After 1000 Cycles

Run No.	Cracking Pressure (psig)		Reseating Pressure (psig)	
	Specimen		Specimen	
	1	2	1	2
1	0.5	0.5	0.1	0.1
2	0.5	0.5	0.1	0.1
3	0.5	0.5	0.1	0.1
4	0.5	0.5	0.1	0.1
5	0.5	0.5	0.1	0.1

Table 9-4. Cracking and Reseating Pressure After 5000 Cycles

Run No.	Cracking Pressure (psig)		Reseating Pressure (psig)	
	Specimen		Specimen	
	1	2	1	2
1	0.5	0.5	0.1	0.1
2	0.5	0.5	0.1	0.1
3	0.5	0.5	0.1	0.1
4	0.5	0.5	0.1	0.1
5	0.5	0.5	0.1	0.1

Table 9-5. Cracking and Reseating Pressure

After Completion of Life Cycle

Run No.	Cracking Pressure (psig)		Reseating Pressure (psig)	
	Specimen		Specimen	
	1	2	1	2
1	0.5	0.5	0.1	0.1
2	0.5	0.5	0.1	0.1
3	0.5	0.5	0.1	0.1
4	0.5	0.5	0.1	0.1
5	0.5	0.5	0.1	0.1

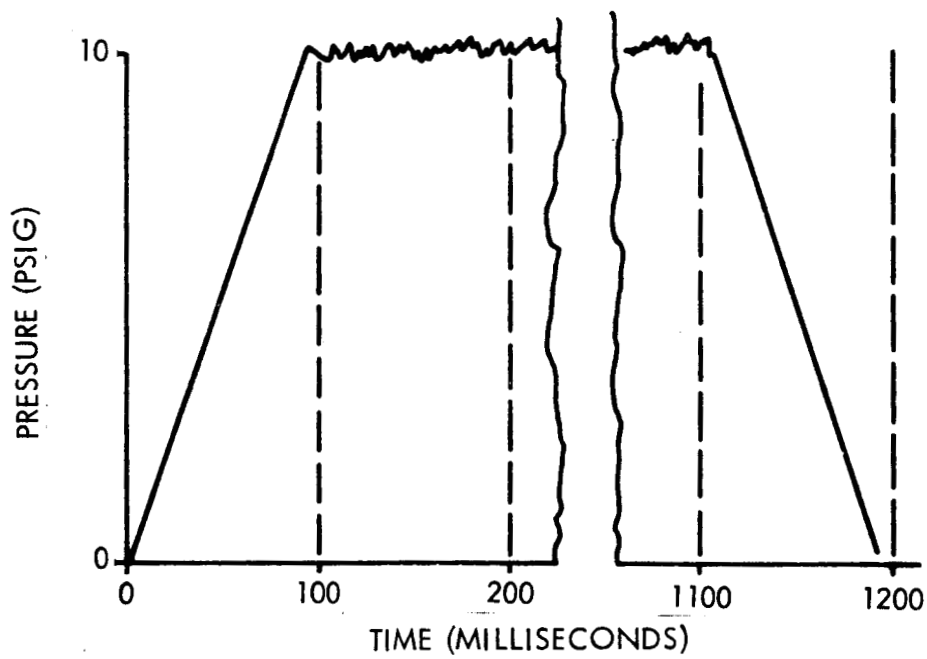


Figure 9-1. Typical Pressure Cycle Waveform

SECTION X

BURST TEST

10.1 TEST REQUIREMENTS

10.1.1 A burst pressure test will be performed on test specimens 1 and 2 to determine whether the specimens will satisfy minimum burst pressure requirements. Pressure shall be applied simultaneously to inlet and outlet ports of specimen 1 and to the outlet port only of specimen 2.

10.1.2 The minimum burst pressure shall be maintained for 5 minutes.

10.1.3 Visual inspection for specimen structural damage and leakage shall be made.

10.1.4 Pressurization of specimen 2 shall be continued until rupture occurs.

10.1.5 The rupture pressure shall be recorded.

10.2 TEST PROCEDURE

10.2.1 Test specimen 1 was placed in a burst test schematic as shown in figures 10-1 and 10-2, utilizing the equipment listed in table 10-2. The specimen was positioned to allow simultaneous pressurization of inlet and outlet ports.

10.2.2 All hand valves were closed and regulator 21 was adjusted for zero outlet pressure.

10.2.3 Hand valves 6, 7, 8, 9, 10, and 11 were opened to fill the specimen and system with water. Fittings were loosened at specimen and at gage 3 as required to bleed all air from the system.

10.2.4 Hand valves 6, 8, 9 and 11 were closed.

10.2.5 Hand valve 5 was opened. Gage 14 indicated 3000 psig.

10.2.6 Switch 17 was closed to open solenoid valve 18.

10.2.7 Regulator 21 was adjusted to provide a pressure of 50 to 100 psig as indicated on gage 15. Pump 19 began operation.

10.2.8 Pumping continued until specimen pressure, as indicated by gage 3 was 600 psig. Pumping was stopped by opening switch 17 which closed solenoid valve 18.

10.2.9 The 600-psig pressure was maintained for 5 minutes. The specimen was examined for structural damage and leakage.

10.2.10 Hand valves 8, 10, and 11 were slowly opened to vent pressure from the specimen and gage 3.

10.2.11 Specimen 2 was installed as shown in figure 10-1 (position 1A) so that pressure was applied to the outlet port only.

10.2.12 Steps described in 10.2.2 through 10.2.9 were repeated, except except the pressure was continuously increased until failure occurred. Failure pressure was recorded.

10.3 TEST RESULTS

10.3.1 Specimen 1 satisfactorily withstood the 600-psig minimum burst pressure. It did not leak or show any evidence of structural damage.

10.3.2 Specimen 2 cracked across the middle member of the valve when the outlet port was pressurized to 2600 psig. The hinged sections of the valve were deformed in a bowed position. The pressure at which the specimen failed was more than four times the required minimum burst pressure.

10.4 TEST DATA

Test data are presented in table 10-1.

Figure 10-3 shows actual damage to specimen 2 resulting from the burst test.

Table 10-1. Burst Test Data

Specimen	Ports Pressurized	Minimum Burst Pressure	Applied Pressure	Remarks
1	Inlet and Outlet	600 psig	600 psig	No leakage or distortion
2	Outlet (only)	600 psig	2 600 psig2	Center member cracked, swing checks warped

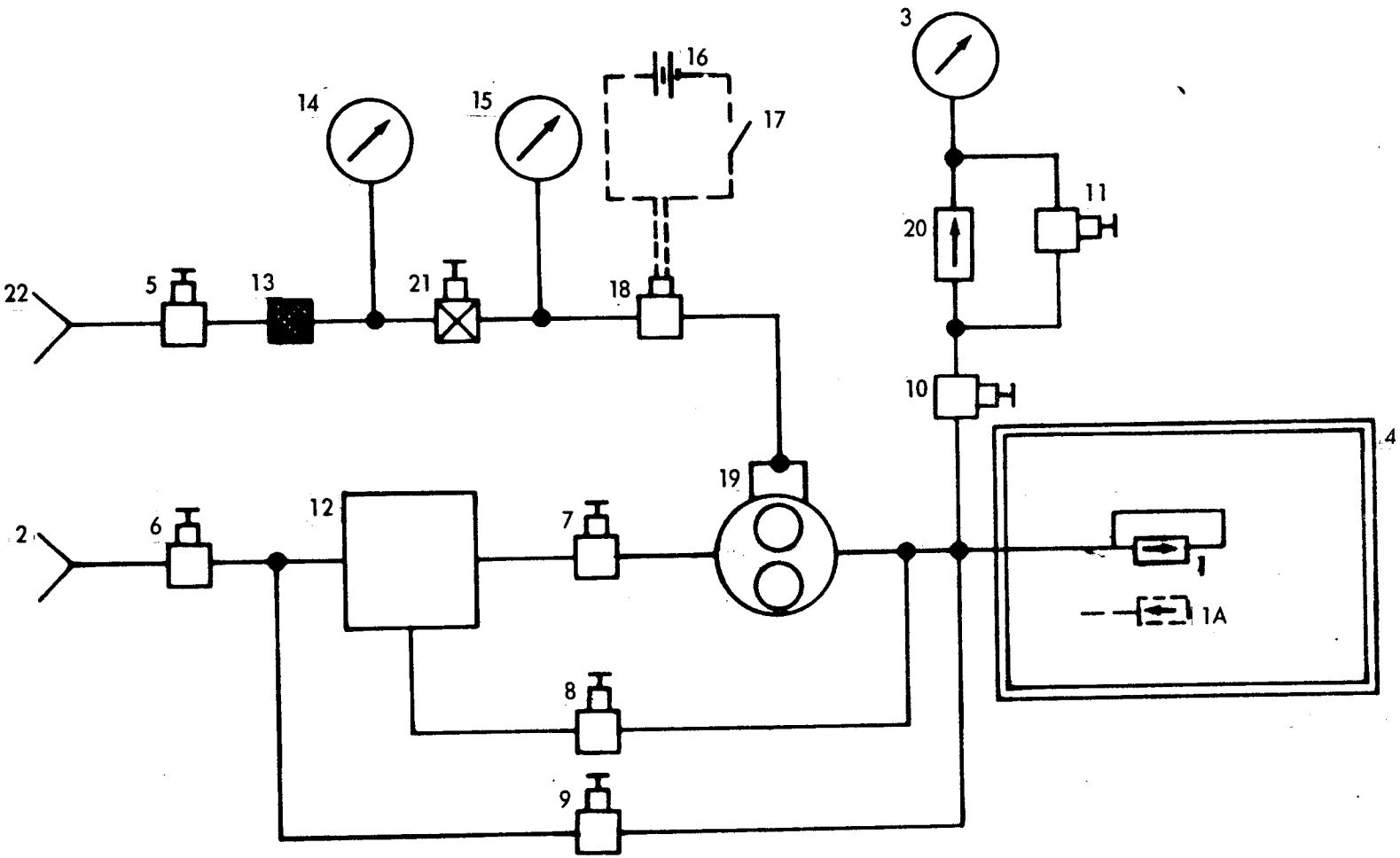
Table 10-2. Burst Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Mission Valve and Pump Company	12-inch C12 AMP 246	NA	12-inch check valve
2	Water Supply	CCSD	NA	NA	Tap water
3	Hydrostatic Pressure Gage	Astra	NA	NASA 011893-A	Range: 0-to 100,000-psig ±0.5% FS accuracy Cal date 11/2/66
4	Burst Chamber	CCSD	NA	NASA 201344	3 ft by 3 ft by 3 ft.
5	Hand Valve	Aminco	50011A	NA	¼-inch
6	Hand Valve	Aminco	50011A	NA	¼-inch
7	Hand Valve	Aminco	50011A	NA	¼-inch
8	Hand Valve	Aminco	50011A	NA	¼-inch
9	Hand Valve	Aminco	50011A	NA	¼-inch
10	Hand Valve	Aminco	50011A	NA	¼-inch
11	Hand Valve	Aminco	50011A	NA	¼-inch
12	Water Reservoir	CCSD	NA	NA	2-gallon
13	Pneumatic Filter	Bendix	1731260	NA	2-micron
14	Pneumatic Gage	Ashcroft	1057S	NA	0-to 5000-psig ±0.5% FS accuracy N.C.
15	Pneumatic Gage	U. S. Gage	8990	NA	0-to 300-psig ±0.5% FS accuracy N.C.
16	Power Supply	Perkin	MRST-28-300A	NASA 009941	28-vdc

Note: N.C. - Not calibrated; for indication only.

Table 10-2. Burst Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
17	Switch	Cutler Hammer	NA	NA	SPST
18	2-Way Solenoid Valve	Marotta Valve Corporation	207803	NA	Normally closed
19	Hydrostatic Pump	Sprague Engineering Corp.	NA	300-16-64	Air operated, maximum pressure of 50,000 psig
20	Check Valve	Aminco	44-6305	NA	¼-inch
21	Regulator	Marotta Valve Corporation	NA	NA	3000-psig inlet, 0-to 125-psig outlet
22	Pneumatic Pressure Source	CCSD	NA	NA	3000-psig



Note: Refer to table 10 for item identification.

Figure 10. Burst Test Schematic

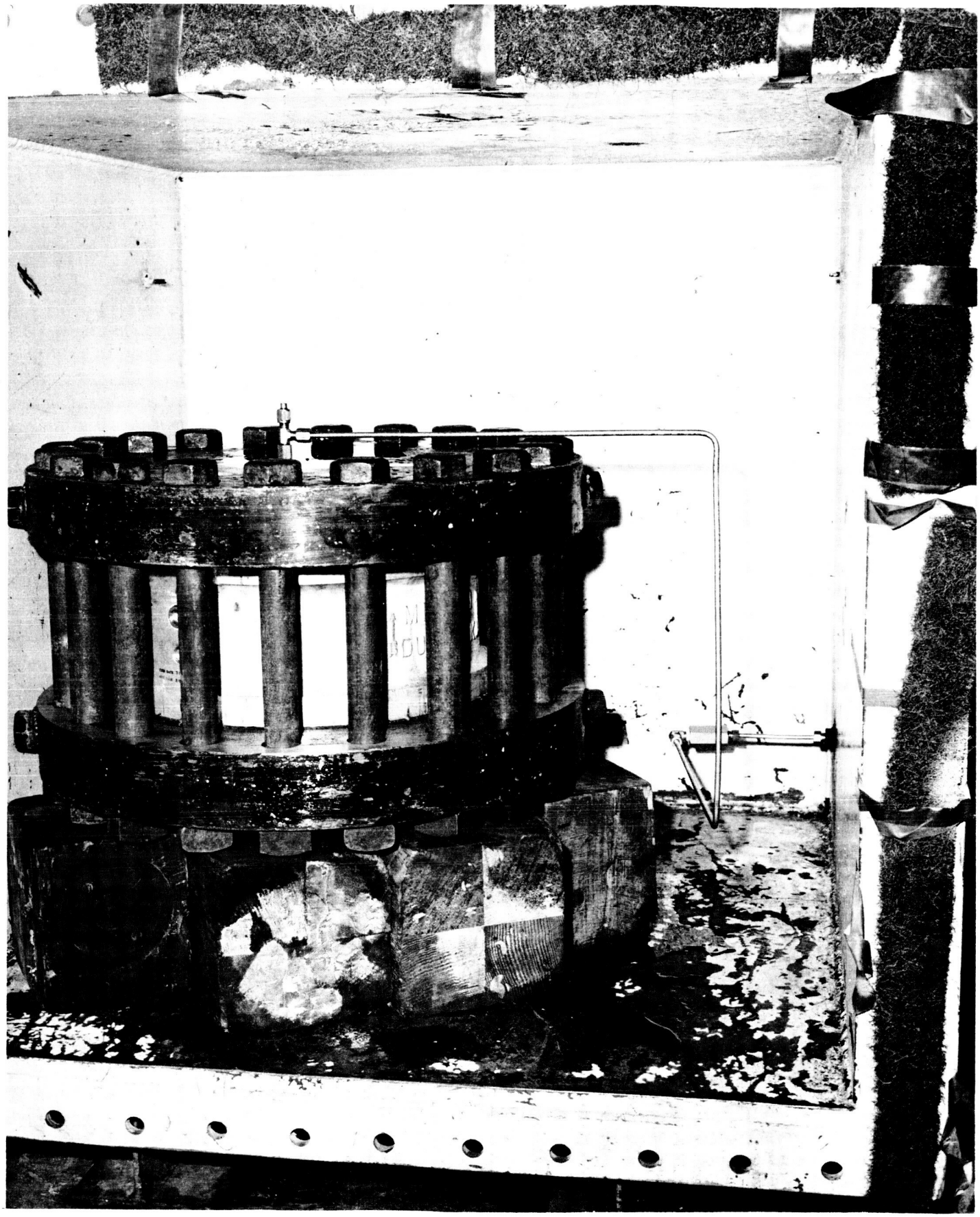


Figure 10-2. Burst Test Setup

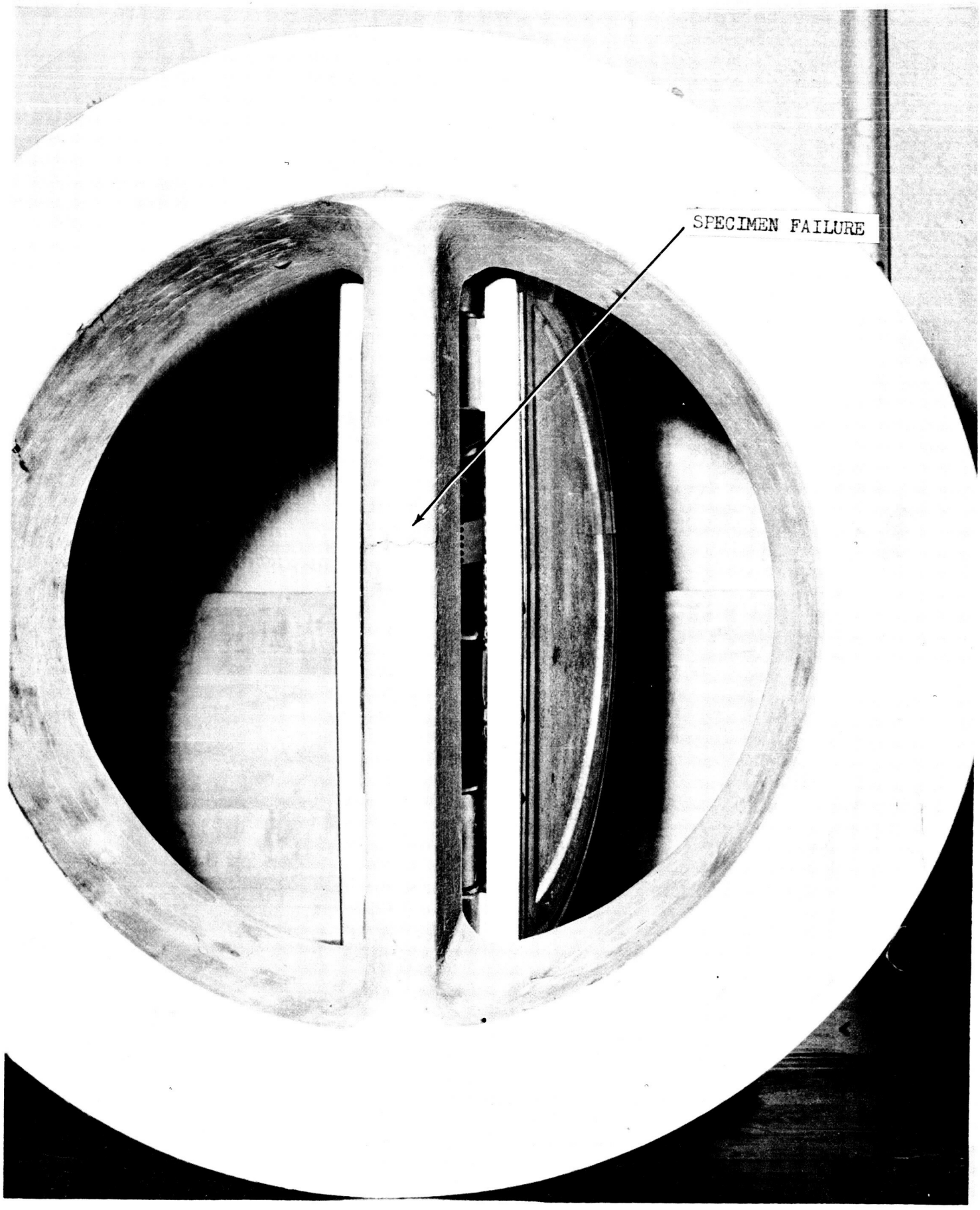


Figure 10-3. Specimen Failure

APPROVAL

TEST REPORT

FOR

CHECK VALVE, 12-INCH

Mission Valve and Pump Company Part Number 12 Amp-246

NASA Drawing Number 75M04406 PCV-4

SUBMITTED BY:

G. Collins
Test and Evaluation Section

APPROVALS:

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